

# In Space Soldering Investigation

Created for the ISS Science Challenge

By Kelly

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- On Earth, soldering relies on gravity for solidification, joint shape, and integrity.
- Bubbles can form that increase risk of cracking and can decrease conductivity between solder joints.
- But in space...
  - reduced gravity = less chance of bubbles escaping → more problems.
  - So a series of soldering samples were produced to explore porosity development, surface wetting, and shape formation.

# Description

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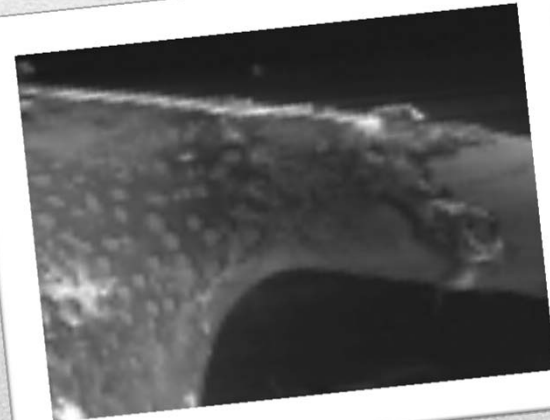


- The samples were heated...



- Then returned to Earth for metallographic examination and property testing

A sample  
returned from  
ISSI



# Description

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- Principle Investigator: Richard Grugel, Ph.D., Marshall Space Flight Center, Huntsville, AL
- Expeditions 7, 8, 9, & 10

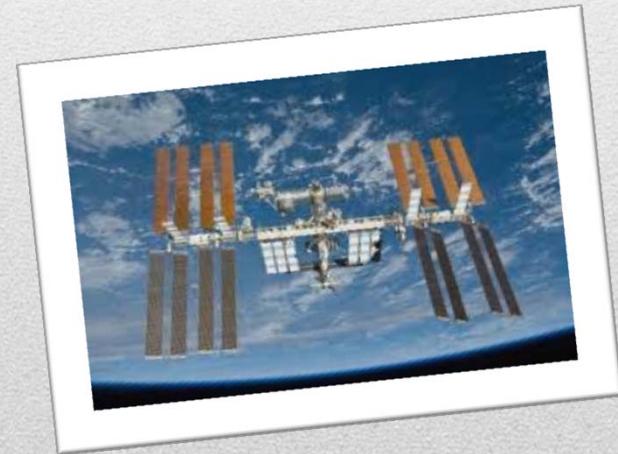


# People

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- How does microgravity affect the integrity and conductivity of soldering?
- How can we improve soldering techniques to maintain the ISS and improve repair capabilities for manned missions to the Moon and Mars?



# What we're trying to learn

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- ISSI was conducted in the Maintenance Work Area of the ISS (which contains smoke and debris from soldering).
- The soldering iron used could be heated to 315.6 degrees Celsius, and is battery powered.
- The samples were returned to Earth for investigation.
- A camera in the Maintenance Work Area provided a downlink for observation.

# Procedures

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- In Space Applications: understanding and developing repair capabilities for future deep space missions and maintenance aboard the ISS.
- Down-to-Earth: better soldering techniques that will improve the integrity and conductivity of solder joints.

**There's an app for that...**

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- There were a total of five soldering sessions and 86 samples, all of which were returned to the investigation team in 2005.
  - The samples were evaluated first nondestructively, then destructively.
  - Something noteworthy: flux movement- the flux was released from the solder while heating, and formed a small droplet that spun around the larger drop of solder (due to a temperature gradient)
    - This was entirely unexpected.
    - The flux movement can't be duplicated here on Earth.
- Flux- a substance used to remove oxides from and prevent further oxidation of fused metal, as in soldering or hot-dip coating

# Results

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"Research is creating new  
knowledge."

-Neil Armstrong

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## NASA Fact Sheet

- [http://www.nasa.gov/mission\\_pages/station/research/experiments/ISSI.html](http://www.nasa.gov/mission_pages/station/research/experiments/ISSI.html)

## Definition of Flux

- <http://dictionary.reference.com/browse/flux?s=t>

## Photo Credit

- [http://www.nasa.gov/mission\\_pages/station/research/experiments/MWA1.jpg](http://www.nasa.gov/mission_pages/station/research/experiments/MWA1.jpg)
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# Sources

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